

**WHAT IS CLAIMED IS:**

1. A starter motor assembly comprising:
  - a housing;
  - an electrical motor provided in the housing having a rotatable armature shaft;
  - 5 a rotatable drive shaft engageably linked with the armature shaft;
  - a pinion assembly provided in the housing engageable at one end with the drive shaft and including a pinion at the other end engageable with a flywheel of an engine;
  - a solenoid assembly provided in the housing for selectively energizing the electrical motor, wherein the solenoid assembly is coaxial with the drive shaft, the solenoid assembly including a plunger having a bore, the plunger being engageable with the pinion assembly to move the pinion assembly including the pinion into engagement with the flywheel; and
  - 10 a return spring positioned at least in part within the bore of the plunger of the solenoid assembly for moving the pinion assembly including the pinion away from engagement with the flywheel, wherein the return spring is spaced from the pinion assembly;
  - wherein energization of the solenoid assembly moves the plunger to move the pinion assembly to engage the pinion with the flywheel; and
  - 20 wherein upon deenergization of the solenoid assembly, the return spring moves the pinion assembly which moves the pinion from engagement with the flywheel.

2. The starter motor assembly of claim 1, further comprising a contact member, the contact member engaging the plunger and engaging the pinion assembly so that movement of the plunger moves the pinion assembly, the contact member being positioned within the bore of the plunger and contacting a contact surface of the plunger, the contact member further being positioned within a groove formed around an external surface of the pinion assembly;

wherein a first end of the return spring pushes against the contact member; and

wherein upon deenergization of the solenoid assembly, the return spring moves the contact member which in turn moves the pinion assembly to move the pinion from engagement with the flywheel.

3. The starter motor assembly of claim 2, wherein the contact member is penannular in shape.

4. The starter motor assembly of claim 2, wherein the contact member is annular in shape.

5. The starter motor assembly of claim 2, wherein the contact member is made of case hardened steel.

6. The starter motor assembly of claim 2, wherein the contact member is made of stainless steel.

7. The starter motor assembly of claim 2, wherein the contact member is made of brass.

8. The starter motor assembly of claim 2, further comprising a plunger stop assembly provided around the pinion assembly, the plunger stop assembly including a groove formed in a surface opposite a surface facing the flywheel, and wherein a second end of the return spring which is opposite the first end of the return spring pushes against the groove formed in the plunger stop assembly.

9. The starter motor assembly of claim 1, wherein the rotatable drive shaft is part of a planetary gear assembly provided in the housing, the planetary gear assembly including a plurality of planetary gears engaged with the armature shaft, each planetary gear being rotatable on a respective pin, the pins being linked to the rotatable drive shaft.

10. The starter motor assembly of claim 9, further comprising a clutch assembly provided in the housing engageable with the drive shaft of the planetary gear assembly and the armature shaft, the clutch assembly having an inner clutch piece, an integrated clutch shell including an outer clutch piece, and rotation control means provided between the outer clutch piece and the inner clutch piece for preventing rotation of the inner clutch piece in a first direction and allowing rotation of the inner clutch piece in a second direction.

11. A starter motor assembly comprising:

a housing;

an electrical motor provided in the housing having a rotatable armature shaft;

5 a rotatable drive shaft engageably linked to the armature shaft;

a pinion assembly provided in the housing, the pinion assembly including a pinion shaft, the pinion shaft engageable at one end with the drive shaft and including a pinion at the other end engageable with a flywheel of an engine, and the pinion shaft including a groove formed around an external surface of the pinion shaft;

10 a solenoid assembly provided in the housing for selectively energizing the electrical motor, wherein the solenoid assembly is coaxial with the drive shaft, the solenoid assembly including a plunger having a bore, the plunger being engageable with the pinion assembly to move the pinion into engagement with the flywheel;

15 a return spring positioned around the pinion shaft without contacting the pinion shaft, the return spring being positioned at least in part within the bore of the plunger of the solenoid assembly; and

a contact member positioned within the groove formed around the external surface of the pinion shaft, the contact member also being positioned within the bore of the plunger of the solenoid assembly;

20 wherein energization of the solenoid assembly moves the plunger which in turn moves the contact member which in turn moves the pinion assembly to thereby engage the pinion with the flywheel; and

25 wherein upon deenergization of the solenoid assembly, the return spring moves the contact member which in turn moves the pinion assembly to move the pinion from engagement with the flywheel.

12. The starter motor assembly of claim 11, wherein the contact member is penannular in shape.

13. The starter motor assembly of claim 11, wherein the contact member is annular in shape.

14. The starter motor assembly of claim 11, wherein the contact member is made of case hardened steel.

15. The starter motor assembly of claim 11, wherein the contact member is made of stainless steel.

16. The starter motor assembly of claim 11, wherein the contact member is made of brass.

17. The starter motor assembly of claim 11, further comprising a plunger stop assembly provided around the pinion assembly, the plunger stop assembly including a groove formed in a surface opposite the surface facing the flywheel, and wherein one end of the return spring pushes against the groove of the plunger stop assembly.

18. The starter motor assembly of claim 11, wherein the drive shaft is part of a planetary gear assembly provided in the housing, the planetary gear assembly including a plurality of planetary gears engaged with the armature shaft, each planetary gear being rotatable on a respective pin, the pins being linked to the rotatable drive shaft.

19. The starter motor assembly of claim 18, further comprising a clutch assembly provided in the housing engageable with the drive shaft of the planetary gear assembly and the armature shaft, the clutch assembly having an inner clutch piece, an integrated clutch shell including an outer clutch piece, and rotation control means  
5 provided between the outer clutch piece and the inner clutch piece for preventing rotation of the inner clutch piece in a first direction and allowing rotation of the inner clutch piece in a second direction.

20. A starter motor assembly comprising:

a housing;

an electrical motor provided in the housing having a rotatable armature  
shaft;

5 a planetary gear assembly providing in the housing, the planetary gear assembly including a rotatable drive shaft engageably linked to the armature shaft, the planetary gear assembly further including a plurality of planetary gears engaged with the armature shaft, each planetary gear being rotatable on a respective pin, the pins being linked to the rotatable drive shaft;

10 a pinion assembly provided in the housing, the pinion assembly including  
a pinion shaft, the pinion shaft engageable at one end with the drive shaft and including  
a pinion at the other end engageable with a flywheel of an engine, and the pinion shaft  
including a groove formed around an external surface of the pinion shaft;

15 a solenoid assembly provided in the housing for selectively energizing the  
electrical motor, wherein the solenoid assembly is coaxial with the drive shaft, the  
solenoid assembly including a plunger having a bore, the plunger being engageable  
with the pinion assembly to move the pinion into engagement with the flywheel;

20 a return spring positioned around the pinion shaft without contacting the  
pinion shaft, the return spring being positioned at least in part within the bore of the  
plunger of the solenoid assembly;

a contact member positioned within the groove formed around the external  
surface of the pinion shaft, the contact member also being positioned within the bore of  
the plunger of the solenoid assembly; and

25 a plunger stop assembly provided around the pinion assembly, the  
plunger stop assembly including a groove formed in a surface opposite the surface  
facing the flywheel, and wherein one end of the return spring pushes against the groove  
of the plunger stop assembly;

30 wherein energization of the solenoid assembly moves the plunger which in  
turn moves the contact member which in turn moves the pinion assembly to thereby  
engage the pinion with the flywheel; and

wherein upon deenergization of the solenoid assembly, the return spring moves the contact member which in turn moves the pinion assembly to move the pinion from engagement with the flywheel.

21. The starter motor assembly of claim 20, wherein the contact member is penannular in shape.

22. The starter motor assembly of claim 20, wherein the contact member is annular in shape.

23. The starter motor assembly of claim 20, wherein the contact member is made of case hardened steel.

24. The starter motor assembly of claim 20, wherein the contact member is made of stainless steel.

25. The starter motor assembly of claim 20, wherein the contact member is made of brass.

26. The starter motor assembly of claim 20, further comprising a clutch assembly provided in the housing engageable with the drive shaft of the planetary gear assembly and the armature shaft, the clutch assembly having an inner clutch piece, an integrated clutch shell including an outer clutch piece, and rotation control means



- 5 provided between the outer clutch piece and the inner clutch piece for preventing rotation of the inner clutch piece in a first direction and allowing rotation of the inner clutch piece in a second direction.